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Metallhalogenidlampenaufbau

Assemblage de lampe aux halogénures métalliques

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Description

This invention relates to electric lamps for general illumination and, more particularly, to electric lamps utilizing a metal halide arc tube mounted in a sealed reflector.

Lamp assemblies incorporating reflectors are well known. Examples include spotlights and floodlights for indoor and outdoor use. Typically, a lamp is mounted in a sealed outer envelope. The outer envelope includes a reflecting interior surface, typically parabolic, for directing light in a preferred direction. The reflector is covered with a lens, and a base is provided for mounting the lamp assembly and for interconnection of the lamp to a source of electrical energy. Incandescent lamps, high pressure sodium lamps and mercury lamps have been utilized in such lamps assemblies.

Recently, it has been proposed to utilize metal halide arc discharge lamps in reflector-type lamp assemblies. Metal halide lamps provide excellent colour, long life and high efficiency. Low wattage metal halide arc lamps include a generally cylindrical arc tube enclosing a suitable fill material such as sodium, scandium and mercury iodides. Electrodes are sealed in opposite ends of the arc tube, and electrode leads extend through press seals for connection to an electrical source.

In a lamp wherein a metal halide lamp is mounted in a reflector, several requirements must be met. It is preferred, in order to maximize light output, that the axis of the arc tube be aligned with the optical axis of the reflector and that the center of light output from the arc tube coincide with the focal point of the reflector. In mounting the metal halide lamp in the reflector, it is not feasible to attach a lamp support to the lens. Therefore, the arc lamp must be supported entirely from the base end. An example of such a lamp is disclosed in US-A-4758759.

It is well known that conductors located in proximity to an arc discharge tube containing sodium cause sodium migration or sodium electrolysis. Sodium ions migrate through the wall of the arc discharge tube and thereby reduce the life of the lamp. It is therefore desirable to keep conducting frame members and power leads away from the arc tube to the extent possible. In prior lamp assemblies, a "frameless" construction has been utilized in which a fine wire connects the electrode at the dome end of the arc tube to the electrical feedthrough at the base end of the lamp. The arc tube is supported by bulb spacers positioned at the base and dome ends of the bulb. The electrically isolated floating frame develops a positive charge which opposes the migration of sodium ions through the arc tube. As noted above, the double-ended mechanical mount is not feasible in a reflector-type assembly.

It has been found desirable to operate metal halide arc discharge lamps in a light transmissive quartz shroud or shield. The shroud substantially surrounds the arc tube and produces a higher and more uniform arc

tube temperature than would otherwise occur. The shroud is in part responsible for the excellent colour temperature and long operating life of the metal halide arc lamp. In addition, it is known that metal halide arc tubes are subject to burst on rare occasions. The shroud functions to contain shards of the arc tube when a burst occurs. The mounting arrangement for the arc tube must provide means for mounting both the shroud and the arc tube.

It is known from JP-A-60/167255 to provide an electric lamp comprising: a lamp envelope including a base for connection to an electrical source; a double-ended arc tube having an upper electrode lead and a lower electrode lead extending from opposite ends thereof; an arc tube support strap attached to one end of the arc tube;

a light-transmissive shroud substantially surrounding the arc tube and abutting against the support strap;

an upper electrode support coupled to the upper electrode lead of the arc tube and extending outside the shroud to the base; and

a lower electrode support coupled to the lower electrode lead of the arc tube and extending to the base, the upper and lower electrode supports coupling electrical energy to the arc tube;

the upper electrode support and the lower electrode support mechanically supporting the arc tube in the lamp envelope.

The present invention is characterised in that a bulb spacer means is provided which engages the neck region of the lamp envelope, the bulb spacer means being coupled to the support strap for positioning and mechanically supporting the arc tube relative to the lamp envelope, and in that the bulb spacer means and the support strap are electrically isolated from the electrode leads and electrode supports.

The shroud typically includes a cylindrical portion coaxial with the arc tube. A first end of the cylindrical portion abuts against the support strap, and a domed portion encloses a second end of the cylindrical portion. In a preferred embodiment, the domed shroud is oriented with its open end at the base end of the arc tube and the domed end at the lens end of the arc tube. The upper electrode support is attached to the upper electrode lead just outside an opening in the domed portion and extends laterally from the upper electrode lead so that the shroud is secured between the support strap and the upper electrode lead.

The arc tube typically includes a flattened, press seal region on at least one end, and the support strap includes a pair of generally S-shaped strips positioned on opposite sides of the press seal region and secured together. The S-shaped strips form laterally-extending legs which support the shroud. The bulb spacer means preferably comprises a pair of arcuate spring elements

coupled to opposite ends of the support strap legs and positioned to bear against an interior neck region of the lamp envelope. The bulb spacer elements are preferably connected to the support strap by interconnecting rods.

In a preferred embodiment, the lamp envelope includes a reflecting interior surface for redirecting light from the arc tube, and a lens enclosing one end of the lamp envelope. The arc tube is typically a metal halide arc discharge tube. The lamp assembly aligns the longitudinal axis of the arc tube with the optical axis of the reflecting interior surface. The electrode supports comprise elongated rigid rods that are attached to the base for mechanical support of the arc tube and shroud, and for coupling of electrical energy to the arc tube. The electrode supports are electrically isolated from the support strap, the bulb spacers and the reflecting surface.

In an alternate embodiment, the domed portion of the shroud is located at the base end of the arc tube and the arc tube support strap is attached to the lens end of the arc tube. Support rods extend from the support strap to bulb spacers located near the base end of the arc tube.

Some preferred embodiments will now be described by way of example only and with reference to the accompanying drawings, in which:

FIG. 1 is an elevational view, partly in cross section, of a preferred lamp in accordance with the present invention;

FIG. 2 is a cross-sectional view of the lamp assembly taken along the line 2-2 of FIG. 1;

FIG. 3 is a cross-sectional view of the lamp assembly taken along the line 3-3 of FIG. 1;

FIG. 4 is an elevational view of a preferred lamp assembly in accordance with an alternate embodiment of the present invention; and

FIG. 5 is a cross-sectional view of the lamp assembly of FIG. 4 taken along the line 4-4.

A preferred electrical lamp in accordance with the present invention is shown in FIG. 1. Detailed views of the lamp assembly are shown in FIGS. 2 and 3. A lamp envelope 10 forms a sealed enclosure for a lamp assembly 12. The lamp envelope 10 includes a reflector 14 having circular symmetry about an optical axis 16. A reflecting surface 18 on the interior surface of reflector 14 typically has a parabolic shape. Reflector 14 is closed by a lens 20. A base 22 provides a means for supplying electrical energy to the lamp assembly 12 and for mounting of the electric lamp. Typically the lamp envelope 10 is filled with nitrogen at a pressure of approximately 53.3 kPa (400 torr). An electric lamp of the type shown in FIG. 1 is typically utilized as a downlight, a spotlight or a floodlight for indoor or outdoor illumination.

The lamp assembly 12 includes an arc tube 30. The arc tube 30 is typically a low-wattage, metal halide lamp such as a type M100 manufactured and sold by GTE

Products Corporation. Arc tube 30 encloses a discharge region 32 containing a fill material such as sodium, scandium and mercury iodides, and argon at a pressure of 13.3 kPa (100 torr). Electrodes (not shown) are sealed in opposite ends of the arc tube 30 and are coupled by electrode leads 34 and 36 through press seals 38 and 40, respectively, to the exterior of arc tube 30.

The arc tube 30 is mounted in lamp envelope 10 with its longitudinal axis on the optical axis 16 of reflector 14. Preferably, a light center 42 of arc tube 30 is positioned at the focal point of reflecting surface 18 for maximum light output in the desired direction.

A light-transmissive shield or shroud 48, substantially surrounds the arc tube 30. The shroud 48 is typically fabricated of quartz and includes a right circular cylindrical portion 48a, an open lower end 48b and a domed upper end 48c. The domed end 48c includes an opening for passage of electrode lead 34. The shroud 48 provides a higher and more uniform temperature during operation of arc tube 30 than would otherwise occur without the shroud. The shroud 48 is in part responsible for the excellent colour temperature and the long operating life of metal halide arc tube. In addition, the shroud 48 provides a containment function in the rare event of an arc tube burst. The shroud 48 absorbs energy from shards of the arc tube 30. Although the shroud 48 may be shattered by a burst, the energy of the burst is partially absorbed so that the shards are completely contained within the lamp envelope 10, shroud 48 preferably has a thickness of approximately two millimeters.

The mounting of the arc tube 30 and the shroud 48 will now be described with reference to Figs. 1-3. As discussed hereinabove, it is preferable to minimize conducting surfaces in proximity to arc tube 30 in order to minimize sodium migration. Preferably, all metal parts are electrically floating, except for the leads which carry electrical energy to the arc tube 30.

A support strap 50 is attached to lower press seal 40 as best shown in FIGS. 2 and 3. The support strap 50 includes a first, generally S-shaped strip 52 and a second, generally S-shaped strip 54 located on opposite sides of press seal 40. To insure a snug fit on press seal 40, the strips 52 and 54 are placed on opposite sides of the arc tube 30 and are moved toward each other until they abut against the sides of press seal 40. Then, the strips 52 and 54 are spot welded together. The press seal 40 is preferably provided with projections 58 above and below support strap 50 to insure that the support strap 50 is correctly and permanently positioned on arc tube 30.

The support strap 50 includes legs that extend transversely from the axis of arc tube 30. Axially oriented connecting rods 60 are welded to each end of support strap 50. In a preferred embodiment, connecting rods 60 extend upwardly a short distance outside shroud 48 and limit lateral movement of shroud 48 along support strap 50. Arcuate bulb spacers 62 are welded to connecting rods 60. The bulb spacers 62 are typically spring

steel and have a curvature which will fit the inside curvature of lamp envelope 10 in the base region. The shroud 48 abuts against the legs of support strap 50. Preferably, the shroud 48 includes notches 64 in the open lower end 48b for engaging support strap 50.

Eyelets 68 are threaded onto electrode leads 34 and 36. The eyelets 68 are typically fabricated from nickel or nickel/silver and assist in making weld connections to the electrode leads 34 and 36. The upper electrode lead 34 and eyelet 68 extend through an opening in the domed upper end 48c of shroud 48 and are welded to an upper electrode support 70. Upper electrode support 70 extends transversely from lead 34 and then extends downwardly outside shroud 48 to the base region of the lamp. Similarly, a lower electrode support 72 is welded to electrode lead 36 and eyelet 68. Lower electrode support 72 extends transversely from the arc tube axis and then downwardly to the base region of the lamp. The downwardly extending portions of the electrode supports 70 and 72 preferably run on opposite sides of the lamp assembly and are angularly spaced from support strap 50 by approximately 90°. This configuration insures electrical isolation between electrode supports 70 and 72, and support strap 50. In a preferred embodiment, the electrode supports 70 and 72 are fabricated of 1.3mm (0.050 inch) diameter, nickel-plated steel rods. The electrode supports 70 and 72 carry electrical energy from an external source to arc tube 30. In addition, electrode supports 70 and 72 in conjunction with bulb spacers 62 mechanically support the lamp assembly 12 in the lamp envelope 10.

With reference to FIG. 1, it is seen that the shroud 48 is secured between support strap 50 at the lower end and upper electrode support 70 at the upper end. The shroud 48 is restrained against lateral and rotational movement by notches 64 and is restrained against lateral movement by connecting rods 60.

The electrode supports 70 and 72 extend into metal cups 80 and 82, respectively, in the base region of the lamp. A brazing material 84 is used for electrical connection between the electrode supports and the metal cups. Wires 86 and 88, attached to the metal cups by spot welding or external brazing, interconnect metal cups 80 and 82, respectively, to the base 22 for connection to a power source. For a metal halide arc tube, an external ballast circuit (not shown) is utilized to provide the required current and voltage levels to arc tube 30. During assembly of the lamp, the brazing material 84 is placed in powder form in cups 80 and 82, and the cups are externally heated, causing a secure connection between each electrode support and the respective metal cup. Preferably, a copper/tin brazing material is utilized. It has been found that a copper/manganese/zinc brazing material is not suitable, since the brazing material and the associated flux fume when heated and can cause a conductive coating on the interior of the lamp. A tubulation 90 on lamp envelope 10 is utilized for evacuation, purging and back filling of the lamp envelope in-

terior.

An alternate embodiment of the lamp assembly is illustrated in FIGS. 4 and 5. An arc tube 102 of the same construction as arc tube 30 is mounted in a light-transmissive shroud 104. The shroud 104 can have the same construction as shroud 48 shown in FIGS. 1-3. In the embodiment of FIGS. 4 and 5, the domed end of shroud 104 surrounds the base end 106 of arc tube 102, and the open end of shroud 104 is adjacent to the lens end 108 of arc tube 102. A support strap 110 is attached to the press seal region at the lens end of arc tube 102. The support strap 110 can be the same as support strap 50, shown and described hereinabove. A frame member 112 is formed of a rigid rod having the shape of an inverted U. The frame 112 is welded to opposite ends of support strap 110. The legs of frame member 112 extend downwardly outside shroud 104 to the region of base end 106. Bulb spacers 114 are welded to each end of frame member 112. A getter 116, such as a zirconium/aluminum, commercially available as ST101 sold by SRES Getters, Denver, Colorado, is preferably attached to frame member 112. A getter 76 of the same type is preferably used in the embodiment of FIGS. 1-3.

As best seen in FIG. 5, eyelets 116 are threaded onto the electrode leads of arc tube 102. The lower electrode lead, and eyelet 116 extends through an opening in the domed portion of shroud 104. A lower electrode support 120 is welded to the lower electrode lead and eyelet 116. The lower electrode support 120 extends transversely from the arc tube axis and then downwardly for attachment to the base. An upper electrode support 122 is welded to the upper electrode lead and eyelet 116. The upper electrode support 122 extends transversely from the arc tube axis and then downwardly outside shroud 104 to the base. The electrode supports 120 and 122 are formed of rigid rods and provide mechanical support for the lamp assembly. In addition, the electrode supports 120 and 122 carry electrical energy to the arc tube 102. The shroud 104 is secured between support strap 110 and lower electrode support 120. The shroud 104 is preferably provided with notches 124 which engage support strap 110 and prevent lateral and rotational movement of the shroud 104. The support strap 110, frame 112 and bulb spacers 144 are electrically isolated from electrode supports 120 and 122. Preferably, support strap 110 is oriented at about 90° relative to electrode supports 120 and 122 for maximum electrical isolation.

Thus, at least in the illustrated embodiments, there is provided an improved reflector lamp assembly; which utilizes a metal halide arc discharge lamp; has a long operating life; which includes a metal halide lamp surrounded by a light-transmissive shroud, suitable for mounting in a reflector; wherein all conductive parts except the electrical inleads are electrically isolated; and which is easily manufactured and low in cost.

Claims

1. An electric lamp comprising:

a lamp envelope (10) including a base (22) for connection to an electrical source;
 a double-ended arc tube (30) having an upper electrode lead (34) and a lower electrode lead (36) extending from opposite ends thereof;
 an arc tube support strap (50) attached to one end of said arc tube;
 a light-transmissive shroud (48) substantially surrounding said arc tube and abutting against said support strap;
 an upper electrode support (70) coupled to the upper electrode lead of said arc tube and extending outside said shroud to said base; and
 a lower electrode support (72) coupled to the lower electrode lead of said arc tube and extending to said base, said upper and lower electrode supports coupling electrical energy to said arc tube;
 said upper electrode support and said lower electrode support mechanically supporting the arc tube in the lamp envelope;

characterised in that a bulb spacer means (62) is provided which engages the neck region of said lamp envelope (10), the bulb spacer means being coupled to said support strap for positioning and mechanically supporting said arc tube relative to said lamp envelope, and in that said bulb spacer means (62) and said support strap (50) are electrically isolated from the electrode leads (34,36) and electrode supports (70,72).

2. A lamp as claimed in claim 1, wherein said support strap (50) includes legs (52,54) extending laterally in opposite directions from the axis of said arc tube (30).
3. A lamp as claimed in claim 1 or 2, wherein said arc tube (30) includes a flattened press seal region (40) at its end and wherein said support strap (50) includes a pair of generally S-shaped strips (52,54) positioned on opposite sides of the press seal region and secured together.
4. A lamp as claimed in claim 3, wherein said press seal region (40) includes outward projections (58) for locating said support strap (50) thereon.
5. A lamp as claimed in any preceding claim, wherein said upper electrode support (70) and said lower electrode support (72) are angularly displaced about said longitudinal axis (16) from said support strap (50).

6. A lamp as claimed in any preceding claim, wherein said bulb spacer means (62) comprises a pair of arcuate spring steel bulb spacer elements coupled to opposite ends of said support strap (50) and located to bear against said lamp envelope (10).

7. A lamp as claimed in claim 6, wherein said bulb spacer elements (62) are connected to said support strap by interconnecting rods (60).

8. A lamp as claimed in any of claims 2 to 7, wherein said shroud (48) includes a cylindrical portion (48a) coaxial with said arc tube (30) and wherein a first end (48b) of said cylindrical portion abuts against the legs (52,54) of said support strap (50).

9. A lamp as claimed in claim 8, wherein said first end (48b) of said cylindrical portion includes notches (64) for engaging the legs (52,54) of said support strap (50).

10. A lamp as claimed in any preceding claim, wherein said lamp includes a reflecting interior surface (18).

Patentansprüche

1. Elektrische Lampe mit

einer Lampenhülle (10), die einen Sockel (22) zur Verbindung mit einer elektrischen Stromquelle aufweist;
 einem zweiendigen Brenner (30) mit einer oberen elektrischen Zuleitung (34) und einer unteren elektrischen Zuleitung (36), die sich von gegenüberliegenden Enden desselben erstrecken; einem an einem Ende des Brenners befestigten Brennerstützbügel (50);
 einer lichtdurchlässigen Abschirmung (48), die den Brenner im wesentlichen umgibt und am Stützbügel anliegt;
 einer oberen Elektrodenhalterung (70), die mit der oberen Elektrodenzuleitung des Brenners verbunden ist und sich außerhalb der Abschirmung zum Sockel erstreckt; und
 einer mit der unteren Elektrodenzuleitung des Brenners verbundenen unteren Elektrodenhalterung (72), die sich zum Sockel erstreckt, wobei die unteren und oberen Elektrodenhalterungen den Brenner mit elektrischem Strom speisen und die obere Elektrodenhalterung und die untere Elektrodenhalterung den Brenner in der Lampenhülle mechanisch abstützen;

dadurch gekennzeichnet, daß ein Hüllenabstandshalter (62) vorgesehen ist, der im Halsbereich der Lampenhülle (10) angreift und der zwecks Positionierung und mechanischer Halterung des

Brenners relativ zur Lampenhülle mit dem Stützbügel verbunden ist, und daß der Hüllenabstandshalter (62) und der Stützbügel (50) von den Elektrodenzuleitungen (34, 36) und den Elektrodenhalterungen (70, 72) elektrisch isoliert sind.

2. Lampe nach Anspruch 1, bei welcher der Stützbügel (50) Stege (52, 54) aufweist, die sich seitlich in einander entgegengesetzten Richtungen von der Achse des Brenners (30) wegerstrecken. 10
3. Lampe nach Anspruch 1 oder 2, bei welcher der Brenner (30) an seinem Ende einen abgeflachten Quetschdichtungsbereich (40) besitzt und bei welcher der Stützbügel (50) ein Paar allgemein S-förmiger Stege (52, 54) aufweist, die an einander gegenüberliegenden Seiten des Quetschdichtungsbereichs angeordnet und aneinander befestigt sind. 15
4. Lampe nach Anspruch 3, bei welcher der Quetschdichtungsbereich (40) nach außen stehende Vorsprünge (58) für die Anbringung des Stützbügels (50) auf denselben aufweist. 20
5. Lampe nach irgendeinem der vorhergehenden Ansprüche, bei welcher die obere Elektrodenhalterung (70) und die untere Elektrodenhalterung (72) um die Längsachse (16) winkelförmig gegenüber dem Stützbügel (50) verlagert sind. 25
6. Lampe nach irgendeinem der vorhergehenden Ansprüche, bei welcher der Hüllenabstandshalter (62) aus einem Paar bogenförmiger Hüllenabstandselementen aus Federstahl besteht, die an einander gegenüberliegende Enden des Stützbügels (50) gekoppelt und derart angeordnet sind, daß sie gegen die Lampenhülle (10) anliegen. 30
7. Lampe nach Anspruch 6, bei welcher die Hüllenabstandselemente (62) durch Verbindungsstäbe (60) mit dem Stützbügel verbunden sind. 40
8. Lampe nach irgendeinem der Ansprüche 2 bis 7, bei welcher die Abschirmung (48) einen zylindrischen Abschnitt (48a) aufweist, der sich coaxial zum Brenner (30) erstreckt, und bei welcher ein erstes Ende (48b) des zylindrischen Abschnitts gegen die Stege (52, 54) des Stützbügels (50) anliegt. 45
9. Lampe nach Anspruch 8, bei welcher das erste Ende (48b) des zylindrischen Abschnitts Kerben (64) für den Eingriff mit den Stegen (52, 54) des Stützbügels (50) aufweist. 50
10. Lampe nach irgendeinem der vorhergehenden Ansprüche, bei welcher dieselbe eine reflektierende innere Fläche (18) besitzt. 55

Revendications

1. Lampe électrique comprenant :

5 une ampoule (10) de lampe comportant un culot (22) pour une connexion à une source électrique ;
 un tube à arc (30) à deux extrémités ayant un conducteur supérieur (34) d'électrode et un conducteur inférieur (36) d'électrode faisant saillie de ses extrémités opposées ;
 une patte (50) de support du tube à arc fixée à une extrémité du dit tube à arc ;
 un bouclier (48) transmettant la lumière entourant de façon substantielle le dit tube à arc et en butée contre la dite patte de support ;
 un support supérieur (70) d'électrode relié au conducteur supérieur d'électrode du dit tube à arc et s'étendant à l'extérieur du dit bouclier à partir du dit culot ; et
 un support inférieur (72) d'électrode relié au conducteur inférieur d'électrode du dit tube à arc et faisant saillie du dit culot, les dits supports supérieur et inférieur d'électrode appliquant une énergie électrique au dit tube à arc ;
 le dit support supérieur d'électrode et le dit support inférieur d'électrode portant mécaniquement le dit tube à arc dans l'ampoule de la lampe ;

caractérisée en ce que

un moyen de séparation (62) du bulbe est prévu au contact de la zone du col de la dite ampoule (10) de lampe, le moyen de séparation du bulbe étant relié à la dite patte de support pour positionner et porter mécaniquement le dit tube à arc par rapport à la dite ampoule de lampe, et

en ce que

le dit moyen de séparation (62) du bulbe et la dite patte de support (50) sont électriquement isolés des dits conducteurs des électrodes (34, 36) et des supports des électrodes (70, 72).

2. Lampe selon la revendication 1, dans laquelle la dite patte de support (50) présente des jambes (52, 54) faisant saillie latéralement en directions opposées de l'axe du dit tube à arc (30).
3. Lampe selon la revendication 1 ou 2, dans laquelle le dit tube à arc (30) présente une zone aplatie de scellement par pincement (40) à son extrémité et dans laquelle la dite patte de support (50) présente une paire de bretelles (52, 54) en forme générale d'un S positionnées sur les bords opposés de la zone de scellement par pincement et fixées ensemble.
4. Lampe selon la revendication 3, dans laquelle la di-

te zone (40) de scellement par pincement présente des projections vers l'extérieur (58) pour loger la dite patte de support (50).

5. Lampe selon l'une quelconque des revendications précédentes, dans laquelle le dit support supérieur (70) d'électrode et le dit support inférieur (72) d'électrode sont angulairement déplacés autour du dit axe longitudinal (16) à partir de la dite patte de support (50). 5
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6. Lampe selon l'une quelconque des revendications précédentes, dans laquelle le dit moyen de séparation (62) du bulbe comporte deux éléments élastiques courbés de séparation du bulbe en acier reliés aux extrémités opposées de la dite patte de support (50) et disposés pour porter contre la dite ampoule (10) de la lampe. 15
7. Lampe selon la revendication 6, dans laquelle les dits éléments de séparation (62) du bulbe sont reliés à la dite patte de support par des barres de liaison (60). 20
8. Lampe selon l'une quelconque des revendications 2 à 7, dans laquelle le dit bouclier (48) comporte une partie cylindrique (48a) coaxiale au dit tube à arc (30), et dans laquelle une première extrémité (48b) de la dite partie cylindrique est en butée contre les jambes (52, 54) de la dite patte de support (50). 25
30
9. Lampe selon la revendication 8, dans laquelle la dite première extrémité (48b) de la dite partie cylindrique présente des encoches (64) pour coopérer avec les dites jambes (52, 54) de la dite patte de support (50). 35
10. Lampe selon l'une quelconque des revendications précédentes, incluant une paroi intérieure réfléchissante (18). 40

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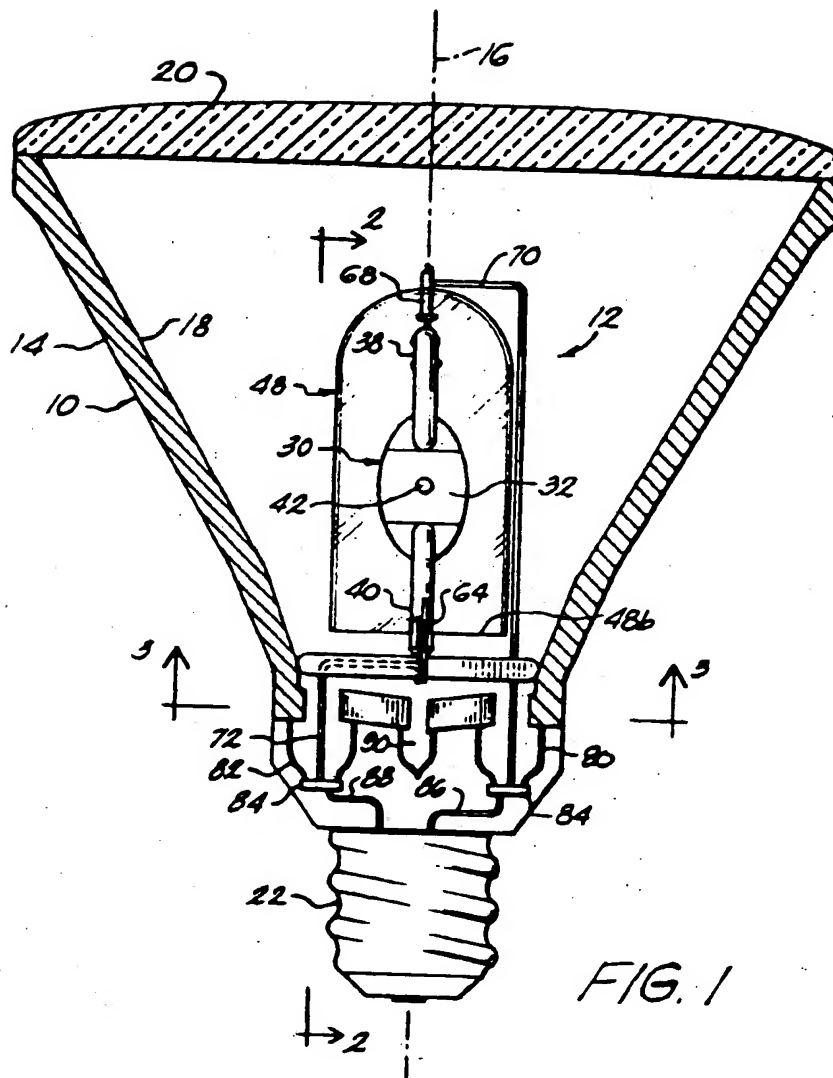


FIG. 1

FIG. 2

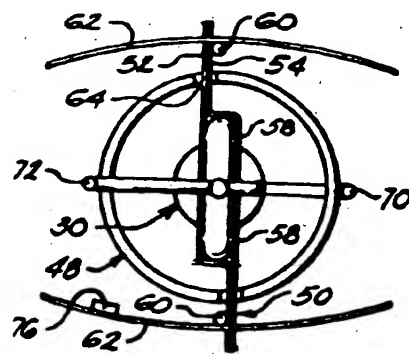
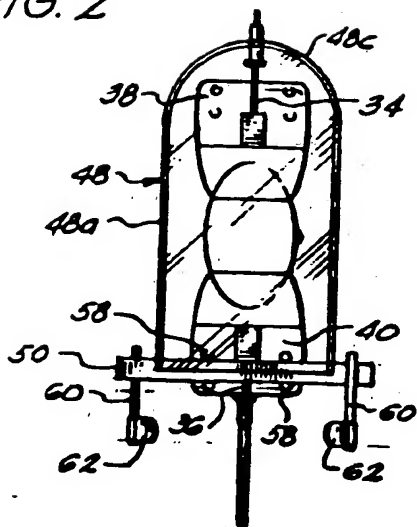
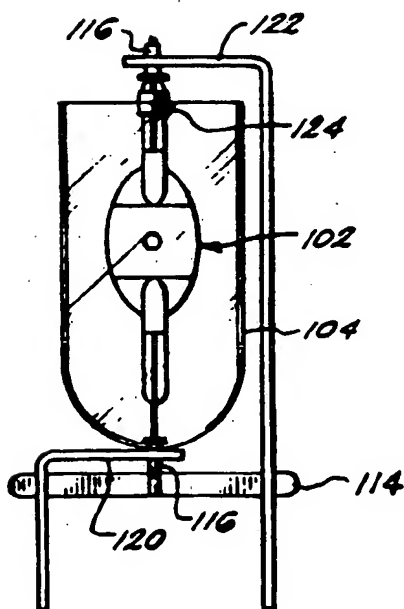
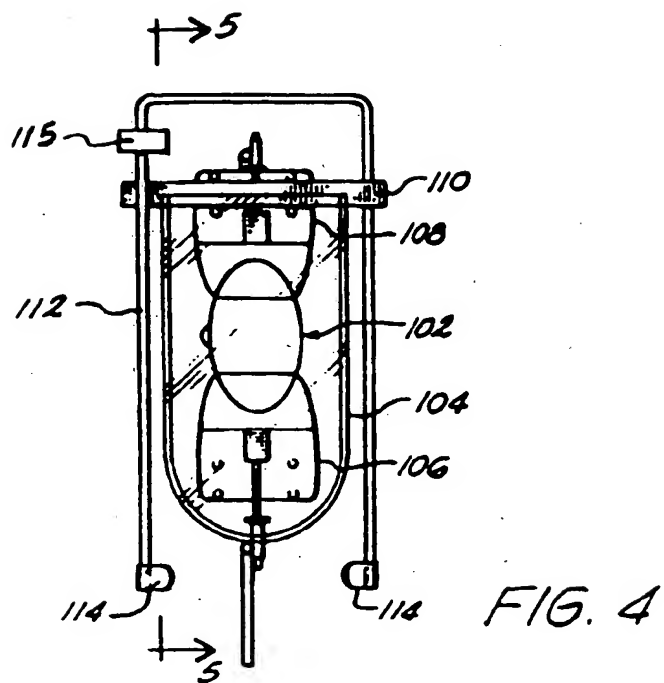


FIG. 3



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